The Journal

OF

The Kansas Medical Society.

Published Monthly by *The* Kansas Medical Society.

Vol. II. No. 3. TOPEKA, KANSAS, AUGUST, 1902. $1.00 per Annum.

Entered at the Postoffice at Topeka, Kansas, as second class mail matter.

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Address all communications relating to Editorial Department to
J. W. MAY, M D., EDITOR,
501-502 Husted Bldg., KANSAS CITY, KANSAS.

Business communications to
THE JOURNAL OF THE KANSAS MEDICAL SOCIETY.
625 Kansas Avenue, TOPEKA, KANSAS.

Vol. II. No. 3. Topeka, Kansas, August, 1902. $1.00 per Annum.

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EXAMINATION OF THE BLOOD BY THE GENERAL PRACTICIAN. *

W. H. GRAVES, M.D., WICHITA, KANS.

Mr. President and members of the Kansas Medical Society: A medical friend said to me the other day: "The old doctors, who had to depend wholly on their observation of superficial phenomena, who had no laboratory aids to diagnosis, were far closer observers than the doctors of to-day with their multiplied mechanisms for the determination of natural phenomena. The absence of such appliances threw them upon their natural resources and developed a keenness of observation and accuracy of interpretation to which the present generation of doctors is a stranger."

There is a morsel of truth in my friend's remark. As the man deprived of sight acquires a finer sense of touch, a keener ear, than does one who enjoys the possession of this boon, so may the doctor who had not learned the use of the thermometer, the stethescope, but who had been a close student of such phenomena as are ascertainable by the unaided senses surpass in purely superficial observation one who

* Read at the Thirty-sixth Annual Meeting of the Kansas Medical Society, Lawrence, May 7-9, 1902.

has called to his aid, and learned to trust, instruments of precision of which his father in medicine knew nothing.

But does the higher development of other senses compensate for the loss of sight? Does the keener ear, the finer touch, give the unfortunate as true an outlook upon the world as these senses less highly developed coupled with sight? Neither could the more highly cultivated, because more constantly used powers of superficial observation give as true a picture of the case, make as accurate a statement of the problem with which the medical attendant has to deal, as is made by the assistance of instruments and appliances which open to us vast fields of knowledge of which our fathers were ignorant.

More than that, time is life. An early diagnosis often means returning health when a late diagnosis is but a prophecy of swift death. The old doctors might have distinguished at an earlier date than we of this day, the pallor, the edema, the weakness due to chronic nephritis; but it is the man with the test tube and the microscope who gives relief to an overtaxed kidney, or prolongs his patient's life by timely injunctions of rest, change of occupation, of diet, of climate. The old doctors might have seen a little sooner than we the flush on the cheek of the phthiscal patient, might have heard a peculiar sound in the cough that does not reach our ears; but it is the man with the clinical thermometer and the stethescope, with the differentiating stains and the oil immersion lens, that robs tuberculosis of its victim. The hand of the old doctor was tender and his touch was light, but he could not gauge the fever as can the thermometer. The eye of the old doctor was keen and his foresight was long, but he could not read the warning of eclampsia which the man of to-day sees in the albumin and hyaline cast.

And my friend was wrong about the old doctor's superior accuracy of interpretation. There are few pathognomic signs—there are few symptoms which may not point, individually, to a number of diverse conditions. Hence the value of the largest possible number of symptoms which may have a bearing on the case. Hence the necessity for approaching the case from as many points of the medical compass as possible. The old doctor was peerless in the use of the methods of investigation which were familiar to him; but the limited means at his command made it impossible for him to differentiate as we of the present day, more fortunate than he in our instruments, are enabled to do.

All honor to the old doctor, to whom the profession owes what of dignity it possesses; who has set for the world a standard of loving service to his kind that is not equalled by that of any other profession;

who has been the repository of the most sacred of confidences and who has kept them inviolate; who was the friend and counselor of five generations; whose gentle pride it was that he brought into the world in his old age the grandchild of the babe whom in his youth he had introduced to mortal life; who knew the history and what was called the "constitution" of the whole village or countryside where his life was passed and whose long acquaintance with individual and family tendencies went far, in the quiet and settled social life of his day, to make up for the lack of diagnostic aids of which we rightly boast.

And all honor to the man of to-day who in the hurly-burly of modern life, with the same devotion to the service of humanity, searches out the secret workings of the most intricately constructed machine in the universe and, after careful consideration of the complex of symptoms, systematically ascertained, and after inquiry into the functions of the organism by methods of which his father never dreamed, accurately points out the cause and the degree of the departure from health, and with a certainty born of a deep knowledge of his subject prescribes the means by which health may be restored, or the life of the invalid lengthened and his path made smoother to the inevitable end.

It is one of the new methods of investigation of which I desire to speak to-day, the examination of the blood as it may be done by the general practician.

It is not derogatory to the general practician to assume that he knows little of the blood and the methods employed for its examination. It is but a few years since the explorers advanced into the field. Many problems yet remain to be worked out; many obscure appearances to be explained; many apparently contradictory facts to be reconciled.

It is not to be expected that the man who holds himself ready to do general practice, to lance a felon, to reset an elbow, to deliver a woman, to treat a tabes dorsalis, to prescribe one hour for a summer diarrhœa and the next to envelop a sprained joint with a plaster cast —it is not to be expected that a man whose services to suffering humanity cover such a wide range as is covered by those of the country doctor, the magnitude and variety of whose responsibilities are only equalled by the heroism with which those responsibilities are discharged—it is not to be expected that such a man can ever acquire the niceties of manipulation, the exactness of technique, the wealth of knowledge in all branches of the medical art as are acquired in any one specialty by one who devotes his life to that branch alone.

It is therefore not to be supposed that the general practician will ever become proficient in all the varied methods of examination that are the delight of the enthusiastic investigator; that he will fill his shelves with an assortment of stains that tax the inventive genius of the faddist. But this much is certain, that a careful examination of the blood by the simple means to be pointed out, in cases of uncertain origin will always result in a more accurate diagnosis than can be made without it; for such a course necessitates a critical review of all other diagnostic points and gives a clearer understanding of the symptom complex.

The examination of the blood will sometimes make the diagnosis, which can be made in no other way, as in leukemia, whether lymphatic or splenomy elogenous. It will oftener furnish the weighty argument in favor of one view and against another, as in a differential diagnosis between typhoid fever and appendicitis; between a hematoma or aneurism and an abscess. It may make all the difference between life and death in telling the observer whether the obscure lump in the abdomen is a misplaced or enlarged kidney or a leukemic spleen. It may clear up a masked pneumonia. It may assure the doctor that the cachexia and weakness are due to the malarial paraisite instead of primary anaemia, or the secondary anaemia of malignant disease and by the absence of pathological findings make clear that a complication much feared does not exist.

All this and much more the examination of the blood, easily made, may tell. And to the objection that such an examination requires much time, I can only reply with the trite observation that there is no excellence without labor; and with the solemn warning that it is better for the peace of mind of the doctor that he take all the time necessary to make a clear diagnosis at the beginning of the case than to feel the reproach of conscience when the later course of the disease or the autopsy discloses the fact that if he had at the beginning known what he was fighting against he could have won the battle.

Permit me then, gentlemen, without further preliminary, to outline the necessary preparation for the examination of the blood, and describe as briefly as is consistent with clearness the technique of the operation as adapted to the needs of the general practician.

What are the necessary appliances? A microscope with 1-5 or 1-6 in. dry lens and 1-12 in. oil immersion, and oculars equivalent to Nos. 2 and 4 Leitz; a mechanical stage; a Thoma hemacytometer; a Gowers hemoglobinometer; an ounce of coverglasses, No. 1, ⅞ in. sq.; a coverglass forceps; a gross of slides with ground edges, thin; a little paraffin; an alcohol lamp, wood alcohol for the lamp; a few ounces

each of absolute alcohol and ether; an ounce of Canada balsam dissolved in xylol and a little xylol for keeping it dissolved; a balsam dropper; a couple of 1 oz. bottles with nipple pipette stoppers are also very convenient for the stains; a 10 g. bottle each of eosin and hemalaiin, the aniline equivalent of hematoxylon; carbolic acid; a fine bistoury; a Davidson syringe; a vial of Toisson's fluid; a vial of distilled water; a nipple pipette 5 ins. long. This outfit, including a scope scarcely inferior to Zeiss' for such work, can be procured for about $150.00.

Those of you accustomed to the examination of the blood may have noticed that I have not included in the list of reagents chloroform and benzol, the fluids commonly used for demonstrating the specific gravity. The only object of this process is the estimation of the amount of hemoglobin made possible by the parallel which usually exists between the gravity of the blood and the amount of hemoglobin, but the fact that certain diseases destroy this parallel, as leukemia and pernicious anaemia, or the condition of ascitis, and the great difficulty in combining the fluids to the proper density, together with the chemical changes which soon begin to take place in the drop of blood employed for the purpose, deprives this operation of all its attractiveness. It is at best a poor substitute for the hemoglobinometer and should never be employed when the other method is available, as it always may be.

The slides and coverglasses must be perfectly clean. They should be washed with soap and water, with distilled water, wiped dry, wiped with a cloth wet with alcohol, then passed through the flame of the lamp. If there is the slightest particle of moisture or oil from the hands the blood will not spread.

Observe these slides with coverglasses fixed with paraffin. They are intended to use for the examination of fresh blood. The blood is preserved from coagulation longer than on an unprepared slide because the air is not admitted to it so freely. They are easily prepared as follows: After cleaning slide and cover as described a moment ago place the coverglass on the slide so that two edges exactly coapt. Now clamp a Cornet forceps on them. Heating a wire in the alcohol flame plunge it into the paraffin and draw the end around the coverglass. The paraffin seals the edges perfectly, leaving free the edge in coaptation with the edge of the slide. When the glasses are perfectly clean the blood on touching the free edge will be drawn between them by capillary attraction; and when the surfaces lie closely together there will be only room for the corpuscle to lie flat, and the blood can be examined for plasmodium malariæ. Vacuolation, when

present, can be detected in the fresh blood, as well as a deficiency of hemoglobin in the pale, washed-out appearance of the red-blood cell.

While the expert hematologist may see much more in the fresh blood specimen, this is about all that the general practician should look for.

The patient seats himself. An assistant stands behind with dry sponges for the purpose of wiping away the blood as fast as it flows, for I am going to stab the lobe of the ear, the discovery of the utility of which was coexistent with the birth of hematology. I stand at his right. Upon the little table at my right hand is spread a piece of sterile gauze on which are a dozen coverglasses, a coverglass forceps, two plain slides and two prepared slides and a Cornet forceps. The Thoma apparatus is open, as also is the Gowes hemoglobinometer, and the stopper is loose in the vial containing Toisson's fluid. There is also a small bistoury, a vial of pure carbolic acid, a vial of alcohol, a vial of distilled water, a nipple pipette for dropping it, and another piece of gauze. These are all ready and within my reach without moving from my position at the patient's side.

Dr. Cabot says that the lobe of the ear needs no preparation. So free is the flow of blood that any possible infection is washed away. Admitting the general truth of the statement, to which there are certainly some exceptions, it is prudent for the doctor to take the utmost precautions. While in hospital practice no harm has come in 10,000 cases done without previous cleaning, it is altogether likely that in private practice in a like number of cases the virulent germ of a damage suit might find its way to the patient's cortical substance with disastrous consequences to the operator. Let the ear, therefore, be cleaned with soap and water, then with alcohol. The bistoury, fine of point and sharp, should be dipped into pure carbolic acid, then into alcohol and dried. The flame is of course the perfect sterilizer, but unfortunately it dulls the edge of the knife, and it is well to have some consideration for the feelings of the patient.

A clean towel on the shoulder. Now a quick stab. The assistant wipes away the drops before they can fall. As long as it is wiped off the blood will continue to flow. I touch a prepared slide to the hanging drop. The blood spreads between the glasses. Another. The surplus blood is wiped away and the slide is laid away. Now, while the blood is flowing freely, I take up the hemoglobinometer. You will notice that I have already put a few drops of water into the little graduated tube. Be careful about that; in an anæmic patient a very little may be too much. I insert the point of the tube into the drop of blood and gently suck up the blood to the 20 cb. mm. mark on the

glass. Wiping off the excess of blood about the point, I insert the point in the graduated tube down into the water and gently blow. The blood escapes into the water and I draw some distilled water into the tube to wash it out. This is repeated till the tube is clean, emptying the washings into the graduated tube. Now the blood is shaken up and compared with the hermetically sealed tube of picrocarmine, which corresponds to the color of a 1 per cent. aqueous solution of blood. Water is added drop by drop, the tube well shaken after each addition until the tubes are of the same color, and we read off the percentage of hemoglobin at the top of the column of diluted blood.

This instrument is meant for use in daylight. It has two faults. If you dilute the blood too much you must do the operation over. You cannot turn a thumbscrew and get a deeper color, as in the Von Fleischl haemometer. And the picrocarmin is apt to fade a little in time, so that your estimates of hemoglobin will likely be a little high. As to the first, slow addition of the diluting fluid renders too great dilution needless; and as to the second, the instrument is cheap, and if the picrocarmin tube becomes too pale it can be replaced at small expense. The Von Fleischl is far more costly, needs artificial light for its proper working, is therefore not so well adapted to use at the bedside, and to most physicians is not so accurate.

I now hold in my hand a Thoma pipette, a tube about 6 inches long, narrow for the most part but expanded near the upper extremity into a bulb. The tube is accurately measured into 1:10 cb. mm., and a line above the bulb indicates that up to that point the pipette contains 101 cb. mm. In the bulb is a little glass pearl, which assists in the mixing, as you shall see. Over the upper end is slipped a small rubber tube, which in time is attracted to a glass or ivory mouthpiece at the free extremity. This mouthpiece is inserted between the teeth, the pointed extremity is plunged into the blood, and gentle suction is made. . . . The subsequent technique needed to be done rapidly, so you will pardon the stoppage of the stream of eloquence, while I return to the primitive instinct of humanity. You observed that as soon as the tube was withdrawn I wiped the blood off of the point, still holding the mouthpiece between my teeth. You could not observe the important fact that I touched the tip of my tongue to the open end of the mouthpiece, thus preventing the further ingress of the blood by capillary attraction, and preventing further its outflow when I cleaned the point of the tube with the piece of gauze. So that there was no perceptible change in the amount of blood in the tube from the time it was removed from the ear till it was plunged into the Toisson's fluid

in this little vial, and the primitive instinct resumed its sway. Those of you who were close enough saw the purple column rise in the tube and fill the bulb. When it reached the mark 101 above the bulb, my tongue again closed the mouthpiece, the pipette was removed from the fluid, held in a horizontal position while it was wiped dry, when the mouthpiece was released. You observed the rotation of the pipette between the thumb and finger while it was filling. This action was to prevent the carrying of the tiny portion of blood on the top of the rising column into the superior constriction of the pipette, which, if done, would materially diminish the number of corpuscles in the chamber, and make a correct estimate impossible.

The rubber tube is now removed from the pipette. This must be done without stretching or compression. Hence it must be pushed or rolled off of the pipette. Now closing the opening with the thumb and finger, the pipette should be shaken well for two or three minutes, that the corpuscles may be well and evenly distributed through the diluting fluid.

The use of Toisson's fluid avoids the necessity for the use of the pipette especially prepared for counting white corpuscles; for I have here, as you see, the "red" pipette. This fluid is compounded after the following formula:

Methyl Violet... 5 B.....	gram.	.025
Sodium chloride.....	gram.	1.
Sodium sulphate.....	gram.	8.
Neutral glycerine.....	c.c.	30.
Distilled water	c.c.	160.

This fluid stains the leucocytes a delicate blue, while leaving the erythrocytes unchanged, so that they may be easily distinguished in the same field. The fluid ought to be filtered before every operation, and refiltered at once through the same paper; for the tiniest shred of fiber which may find its way into the counting chamber may obscure one or more corpuscles and thus, when multiplied by 800,000 or 1,000,000 as hereinafter described, materially interfere with the accuracy of the count.

The count may now proceed; or if the blood be taken at the bedside the pipette may be closed by a heavy rubber band and carried to the laboratory for estimation.

I hold in my hand the glass slide which contains the counting chamber. It is, as you see, a heavy piece of polished glass, on which is cemented a disc, upon the upper surface of which are ruled a number of microscopic lines, 1:20 of a millimeter apart, perpendicular to each other, forming squares of the area of 1:400 of a sq. millimeter.

This disc is surrounded with a square glass plate with a circular opening a little larger than the ruled disc. The surface of the square plate is exactly 1:10 of a millimeter higher than the surface of the disc. Multiplying the area enclosed by four of the microscopic lines by the depth of the disc below the glass square, we get a cubic content of 1:4000, which is a fixed fraction. This fraction multiplied by the fraction indicating the dilution of the blood gives us the ratio which the number of corpuscles in one square bears to the number of corpuscles in a cubic millimeter of blood.

Let us now suppose that the blood is drawn to the .5 mark in the tube of the pipette. As, in the filled pipette, no blood is left in the tube, but is all in the chamber, the dilution is .5 to 100, or 1:200. Therefore, as every cb. mm. of the dilution contains 1:200 of the number of corpuscles contained in an equal amount of blood, we multiply the fixed fraction of 1:4000 by 1:200, which gives us the ratio of the corpuscles found in a single square of the dilution to the number of corpuscles found in a cb. mm. of blood, or 1:800000.

If in taking the blood you have run the column above the .5 mark, which is the point aimed at, do not attempt to dislodge the column. Do not blow into the pipette. Note the point reached, .6 or .62, or whatever it may be, and make your calculation to correspond with the fact. Thus if the column is .6, the dilution is 1:67, and the ratio of corpuscles in a square to the number in a cb. mm. is 1:668000. Likewise, if you have a good column at .4, and the point slips out of the drop, don't try again, but ascertain the dilution, which in that case is 1:250, and your ratio, which is 1:1000000.

Each counting chamber is accompanied by a ground glass slide This should be cleaned perfectly, as prescribed for the common covers. It must not be touched by the fingers after it has passed through the flame. The surfaces of the disc and the surrounding square are now cleaned and polished by a piece of gauze. A little soapy water followed by distilled water should be the only fluid used. Alcohol dissolves the cement which holds the pieces together. It should now be passed through the flame and turned face down, keeping the disc free from touch of anything.

The pipette is now taken up and again shaken. A few drops are now blown out of the tube, to get rid of the unmixed diluting fluid, and the point of the pipette again wiped dry. Now let the fluid flow down by the mere attraction of gravitation, and touch the point to the ruled disc. If any part flow over into the little moat around the disc, the slide must be recleaned and another drop put on. A little less than enough to exactly cover the disc does no harm.

Now replace the coverglass held by forceps which have just been wiped and passed through the flame. Care has been taken that no dust could lodge on the slide placed downward. Hence you may safely count on perfectly coapting surfaces. Place this slide on the stage of the scope, kept perfectly horizontal in order to avoid any displacement of the corpuscles, and wait five or ten minutes for the corpuscles to settle to the surface of the disc.

While the corpuscles are settling permit me to make some suggestions about cleaning the pipette. Don't try to blow out the contents. There is a much easier and quicker way of getting rid of them. And it is not the way suggested by DaCosta in his recent admirable work on hematology, of twisting the attached rubber tube. That is a delusion. But attach your Davidson syringe to the pipette by means of a small rubber tube and pump. The fluid disappears. Now remove the tube and attach this small pipette nipple and draw in distilled water. If you have no conscientious or gestatory objections to the taste of water, the old original instinct may be brought into play again. After a thorough washing with water repeat the process with absolute alcohol; follow with ether, and when the ether is expelled continue pumping until the little glass pearl rattles round in the bulb freely. Then the instrument is clean and dry. The same process should be followed in cleaning the pipette of the hemoglobinometer.

Almost any magnification can be used for making the count if the definition be clear. I have used a Zeiss C lens and 4 ocular, which brings to view a field 1 mm. in diameter, there being 20 squares reaching across the field. This is a very low magnification, and it is rather difficult to make the count. I am now using a No. 5 Leitz ocular with the same lens, the diameter of the field being equivalent to 12 squares in length. Higher powers can be used. The essential thing is to get the area of the field in squares and then count the field. Thus I have a field of a diameter of 12 squares. 12x12x.7854 equals 113.1, the area of the field. Is it 5 squares in diameter? 5x5x.7854 equals 19.635. This small field can easily be counted without paying any attention to the lines etched on the glass, and has the advantage of enabling the observer to count anywhere on the disc that he pleases. In the larger field it is necessary to use the lines in counting from side to side. In either case attention to the individual square, with the hundreds of numbers to set down, is entirely unnecessary. Count clear across. Count all corpuscles that touch one side of the field and omit all that touch the other side. If the corpuscles are evenly distributed and the results of counts of two fields are close, that is enough. Add together the numbers counted, divide by the

number of squares in the area, carrying out the decimal to at least four points, multiply by the number representing the ratio, and you have a very close approximation to the number of corpuscles in a cubic milimeter of blood.

Thus, let us suppose that I have 1385 reds in two fields, containing 226.2 squares, and that the dilution of the blood is exactly 1.200. This gives an average of 6.1229 to the square, and this number multiplied by 800,000 equals 2,898,320, the required number.

How about the white corpuscles? As the reds are very evenly distributed and average 692 to the field we simply move the slide along by means of the mechanical stage till we have examined 20 fields. In those 20 fields we find, let us suppose, 25 leucocytes, an average of 1 to 654 reds, or 8841 in a cb. mm.

Let us now turn our attention to the coverglass smears. I take a cover and hold it between thumb and finger by adjacent corners. With the other hand I hold another glass in the same way and touch it to the small drop of blood and lay it on the first. The blood spreads easily. Now I separate them by sliding one off of the other. This is much better done by the hand than by the forceps which, by their inflexibility, are almost certain to make an imperfect smear. The drop of blood can hardly be too small.

These preparations being dried we place them in absolute alcohol and ether, equal quantities, for half an hour, taking care that they do not lie one on another, thus interfering with the action of the fluid. At the end of that time they are sufficiently fixed. They are now dried, when they are ready to stain.

For staining the blood I would not advise the general practitioner, least of all in the beginning of his work, to attempt the use of the triacid stain. It is difficult to make, is often disappointing, and frequently loses its staining qualities in a short time. Moreover, the preparation of the coverglass for the triacid requires no little skill in treating. If underheated the cells are opaque, if overheated are pale, taking the stain imperfectly; while the eosin and hemalaiin are very permanent, produce clear pictures, and the preparation of the coverglasses for these stains requires but a few minutes immersion in a fluid of definite proportions.

Inserting the coverglass between the jaws of the cornet forceps, taking care that the jaws do not come too close to the edge of the glass, pour from the pipette stopper of the eosin bottle enough of the 5 per cent. stain to cover the specimen, and immediately wash it off with running water from a faucet or wash bottle. Now flood it with the

5 per cent. hemalaiin stain and leave it about 5 minutes. You will have to vary the time as your stain is stronger or weaker.

These contrast stains will disclose to the doctor every condition of the blood that is of known pathological value.

Wash off the hemalaiin, take off the excess of water with a filter paper, dry over the alcohol flame, holding meanwhile between the fingers, and without further delay mount in balsam. The slide is now ready for examination, which should be made with an oil immersion lens.

I can not do better in closing these remarks than to quote the final paragraph of the introduction to Da Costa's recent work:

"The technique of blood examinations," he says, "is neither elaborate nor difficult to master. Necessarily it must be rigidly exact, but no more so than any other branch of physical diagnosis, if the worker is content only with the best results. To acquire a good working knowledge of hematology takes but a fraction of the time and application that one must spend in familiarizing one'self with the most common heart murmurs or chest signs, equips the physician with an additional diagnostic agent of the greatest value. If the newly graduated physician would provide himself with a microscope and a set of blood instruments, and systematically study the blood in the various general diseases which he encounters in practice, many a slipshod diagnosis might be avoided, and a great stride forward made in popularizing this practical branch of clinical diagnosis."

DISCUSSION.

Dr. Glasscock: I was very much interested in the paper just read, and am sorry that the doctor did not give us the last part of it. Now, this matter of blood examination should be of general interest, and more attention should be given to it by the general practitioner, because of the great benefit in the matter of diagnosing cases. Unfortunately, however, for our interest and enlightenment, the doctor only read the first part of his paper, which is simply the "a. b. c." of the subject. I expected to hear something more about the manner of procedure in these cases and the results arrived at. Now, I infer that the doctor is an enthusiast on his subject. We who have become familiar with the ways of the older practitioners are sometimes rather inclined to be sceptical on some of these points; however, we all know that very much has been accomplished by the use of the microscope, and many diagnoses made and cases cleared up, which without its aid would have been impossible. But the most careful observer is yet capable of making mistakes; or the microscope may yield negative

results when other signs may indicate almost to a certainty the existence of a certain disease. Speaking of differentiating between typhoid fever and appendicitis. The typhoid reaction is not manifest in the blood until the seventh day, and my experience with cases of appendicitis is that the man has "gone home to glory" long before the seventh day! In fact, to my mind it is a question whether or not the typhoid reaction is of very much value in such instances. It is of no value in mild cases, as no reaction occurs at all. To the general practitioner who does not enter the abdominal cavity it seems very absurd to believe that any man, after several days' observation of a case would make a mistake in differentiating between typhoid fever and appendicitis, but the surgeon has been called in more than once to operate upon a case of supposed appendical inflammation. Even the eruption on the abdomen is not an invariable accompaniment of typhoid, and loses much of its differential significance.

Dr. Hertzel: I would say that in the differentiation between typhoid fever and appendicitis, leucocytosis is an invariable accompaniment of severe cases of appendicitis, a most valuable point of differentiation between the two diseases.

Dr. Purvies: In my experience the diagnostic value of blood examination has been more marked than any other means of diagnosis. For example, I will make mention of two or three cases which have come under my own observation. A man came from Goddard for treatment and advice, with what had been diagnosed as cancer of the liver. He was examined by men who were in no way superior to those who already had charge of the patient. A microscopical examintion of the blood showed distinctly the aestivo-autumnal variety of the malarial parasite. He was treated for malaria, and in two months went home a well man. When he first came he was unable to walk unassisted. Another patient had been treated for gastritis. Blood examination revealed malaria, for which treatment was given. Patient got well. Another case came in for operation for tumor. A proper haemanalysis showed leucaemia, for which treatment was substituted for the operation. Recently two cases of pernicious anaemia came in for treatment, both had already been diagnosed as carcinoma of the stomach, with various complications and heart lesions. Examination proved the heart lesions to be haemic murmurs, and the blood examination revealed characteristic symptoms. I think that a great deal of stress should be put upon this matter of blood examination. Practitioners in general do not employ the blood count enough, it should be employed oftener in diagnoses.

Dr. Graves: There are two men who are most unwise, the man who ignores laboratory aids to diagnosis, and the man who depends upon them to the exclusion of physical signs. The combination of these two, marks the wise man. It is neither claimed nor expected that the microscope will always make an unerring differential diagnosis, but it will oftentimes clear up many points and enable the practitioner to arrive at conclusions which otherwise might never have been reached. In many cases the microscopical findings are of a negative character, the reaction being entirely absent, or almost absent, even where the infection is strong. If the affection is light it may escape very marked appearances. There are many things yet to be cleared up along these lines, I'll admit, and I cannot do better, in closing, than to read a paragraph from my paper; not my own words, but a quotation from Da Costa's recent work: "The technique of blood examinations," he says, "is neither elaborate nor difficult to master. Necessarily it must be rigidly exact, but no more so than any other branch of physical diagnosis, if the worker is content only with the best results. To acquire a good working knowledge of hematology takes but a fraction of the time and application that one must spend in familiarizing himself with the common heart murmurs or chest signs, and equips the physician with an additional diagnostic agent of the greatest value. If the newly graduated physician would provide himself with a microscope and a set of blood instruments, and systematically study the blood in the various general diseases which he encounters in practice, many a slip-shod diagnosis might be avoided, and a great stride forward made in popularizing this practical branch of clinical diagnosis." Let me say one word in conclusion. While I am an enthusiast upon the subject of blood examination, I am no more so than in any other line of methods of examination which will tend to bring out the proper diagnosis of disease, and I am simply a general practitioner.

FIVE CASES OF EXOPHTHALMIC GOITER.*

C. H. MORRISON, M.D., GREAT BEND, KANS.

The five cases of exophthalmic goiter under consideration were all observed for a considerable length of time before the development of all of the cardinal symptoms upon which a diagnosis of this peculiar disease is usually based. This period of deferred diagnosis was necessarily a period of doubt. Several disorders were suspected, one after another. The treatment was symptomatic and without lasting results.

A study of these cases and of the literature of the subject led me to the belief that, as a rule, a diagnosis ought to be made before the appearance of the exophthalmos. It also led me to the belief that, occasionally, individuals who are supposed to be afflicted with anemia, chlorosis, neurasthenia, or with some disease of the uterus or its appendages, in reality may be afflicted with hyperthyroidation. In support of these conclusions I will detail the leading symptoms as they occurred in the clinical course of these cases.

Case 1.—Female, single; age, 20; was first seen in June, '99. She gave a history of moderate attacks of hemicrania occurring at irregular intervals in the preceding two or three years; frequent headaches, leukorrhea, dysmenorrhea of the neuralgic type, and insomnia. She was anemic, nervous, and irritable. She exhibited considerable muscular weakness. Her nutrition was poor. Her pulse was irregular and usually about 90. She had occasional attacks of palpitation attended by some precordial pain and moderate dyspnea. There were no cardiac murmurs. There was no edema of the extremities. She frequently felt hot waves spread over the entire body while the skin became reddened, moist and warm. She remained under observation about six months during which time there was little deviation from the symptoms outlined above. Eighteen months later she presented herself a second time. Her pulse was 140, thyroid gland was markedly enlarged and her eyes protruded to such an extent that the lids would not completely close over them. All of the symptoms noted at the first period of observation had become more prominent.

Case 2.—Female, married; age, 35; was first seen in July, 1900. Mother, two sisters, an aunt, and three cousins had simple goiter. Patient had a very large goiter which had appeared when she was sixteen years of age. She was nervous and irritable, had headaches and backaches. She was easily exhausted and did not rest well at

* Read at the Thirty-sixth Annual Meeting of the Kansas Medical Society, Lawrence, May 7-9, 1902.

night. Her appetite was capricious. Her nutrition was fair. She was sometimes troubled by constipation, more frequently by diarrhea. She complained of leukorrhea, and irregular, scanty and painful menstruation which had existed from the establishment of the menses. She frequently suffered from palpitation of the heart, always accompanied by dyspnea. Any unusual exertion, as climbing stairs, was followed by difficult breathing. There was occasional edema of the extremities. There were no cardiac murmurs. Her pulse averaged about 95. After a few weeks she fell into the hands of an amateur gynecologist who repaired a slight laceration and did a curettage, neither of which had any noticeable effect on the long train of nervous symptoms. One year afterward she again presented herself at my office a typical picture of exophthalmic goiter.

Case 3.—Female; single; age, 18. Was seen first in August '99. She was anemic, nervous and myasthemic. Her appetite was poor. She was frequently troubled by diarrhea. She complained of vague and indefinite pains in the abdominal regions, back and sides. She always had headache. She complaimed of leukorrhea. She was restless at night and woke unrefreshed. She had occasional attacks of extreme pain in the right iliac region. These attacks usually necessitated her going to bed for two or three days, were never attended by a rise of temperature, and always resisted treatment. Her pulse was irregular, rapid and feeble. There were no cardiac murmurs. There were were no edemas. I occasionally saw this patient for a year and then saw no more of her until November, 1901. At that time the train of cardinal symptoms was present and very prominent.

Neither of the two following cases have developed the ophthalmos but I believe the existing symptoms warrant the diagnosis.

Case 4.—Female; age, 11; menstruation not established. Her mother, grandmother, and an aunt on the mother's side had simple goiter. She is of a nervous disposition and irritable, cries on slight provocation, tosses about in her sleep, a fine tremor affecting the head, upper extremities and chest often appears. She does good work in school but after a few weeks loses her appetite, grows pale and listless, has headaches and has to be kept away from her studies. She has occasional attacks of extreme precordial pain radiating toward the left shoulder. These attacks are accompanied by severe palpitation and marked dyspnea. They are of two or three hours duration. After the paroxysm has subsided, pain of a lancinating character, aggravated by respiratory movements, lasts for two or three days. During the intervals between paroxysms the pulse ranges from

90 to 100. During the paroxysm it is about 140. There are no cardiac murmurs. There is marked enlargement of the thyroid gland. There is no exophthalmos. This case is peculiar in the fact that the disease has appeared before the period of puberty.

Case 5.—Female; age, 15; menstruation established two years ago. She is extremely nervous and irritable; goes to bed at 9 or 10 o'clock, goes to sleep at 2 or 3, tosses about in her sleep, wakes in the morning exhausted. Her appetite is usually poor. She has had headaches for two years. She has hyperopia and astigmatism. A correction of the eye strain does not relieve the headaches. She is losing flesh. She tires upon the least exertion. She has hot and cold waves. Almost every day she has pain in the precordial region. Every few days she has palpitation and dyspnea. Her pulse ls irregular, never below 100, often as high as 120 after exertion. She has some edema of the feet. There are no cardiac murmurs. There is a slight turgescense of the thyroid gland. There is no ophthalmos.

In each of these cases the first symptom which attracted much attention was the rapid heart. In each instance there was no organic lesion. There was no manifest lesion or disease of any organ of which the tachycardia might have been considered symptomatic. The rapid heart, the paroxysms of palpitation and dyspnea stood out as prominent symptoms of some grave disorder which could not be located. With the development of the heart symptoms, there appeared symptoms of nervous disorder which while presenting many points of similarity were different in each case. The headaches, backaches, myasthemia, gastric and cardio-vascular disturbances and leukorrheal discharges which were present in most of these cases, suggested some uterine disorder, but neither inflammatory condition nor malposition of the uterus or of any of its appendages could be found in such degree as to account for the aggregation of symptoms. Neither could there be found any error of development or neoplasm. When the physician is consulted by a woman complaining of a variety of nervous disorders and he can discover no good reason for their existence, he is apt to charge them to some pelvic derangement. In one of these cases I made this error. In another I made the diagnosis of chlorosis and after several weeks of unavailing effort, during which time my patient grew steadily worse, I found a distinct enlargement of the thyroid gland. Another case was treated a short time under the idea that it was a case of gastro-intestinal auto-intoxication. Neurasthenia was considered in all of these cases.

Neurasthenia enters into and plays a prominent part in this disease

but continued observation of the case reveals the fact that it is not the disturbing element.

Most authorities state that a positive diagnosis must not be made until the rapid heart, the goiter and the exophthalmos are all present. One of my cases developed the goiter at the age of 16 and thinks that the cardiac symptoms appeared at about the same time. The exophthalmos did not appear until she was 36 years old. During all of this time she had never been well. Most of the time she was under treatment. In view of these facts it seems that twenty years is too long a time to be spent in making a diagnosis. A heart that for months never beats less than 90 or 100 per minute, is without lesion, and accompanied by one or all of the nervous symptoms detailed in these five cases, should cause one, after careful exclusion of a few other diseases, to strongly suspect exophthalmic goiter and to treat it accordingly. After the rapid heart and nervous symptoms have existed for some time and the goiter appears, other diseases being excluded, a positive diagnosis should be made. The tremor mentioned in one of these cases when it appears assists materially in making the diagnosis.

The cause of exophthalmic goiter is, to some extent, a matter of speculation, but it seems to be fairly established that it is due to an over-production of the natural secretion of the thyroid gland. In the normal individual the rapid heart and the nervous symptoms of exophthalmic goiter may be induced by the administration of the thyroid extracts. The cardio-vascular and nervous symptoms of the disease appear from several months to several years before the goiter and exophthalmos. If we accept the theory that the disease is caused by a hyperthyroidation, we must accept the idea that the abnormal heart action and symptoms of nerve disorder are due to the same cause. The great irregularity in the time of development of the cardinal symptoms makes it seem possible that all of them might never appear and yet the patient be afflicted with this disease. It is not an uncommon occurrence for a physician to see a woman who is afflicted with a set of symptoms corresponding to the first symptoms of exophthalmic goiter. He is often at a loss to account for them. After a time his patient recovers. It seems to me that she may have been suffering from an over activity of the thyroid gland.

Some day someone will describe a new disease. It will be as easily recognized and as well known as epilepsy or apoplexy. The goiter and exophthalmos will be noted as symptoms that may or may not appear during the course of the disease. The name of this disease will be hyperthyroidea or some name of like significance.

DISCUSSION.

Dr. Lindsay: I was very much pleased to hear the paper just read. It seems to me that the last sentence is very proper and pertinent, that instead of the symptoms furnishing a name for the disease, as the writer says, it will be identified and described under a name which will be significant of the pathological condition of the organ affected, the enlargement of the gland itself, and a very proper classification, giving a clue to the nature of the disease. I have been particularly interested in that feature of the thyroid gland which shows conditions of myxodema, indicating a loss of function, more than with those accompanying the enlarged state of the gland itself. In treating these cases of myxodema we have had more brilliant results from the use of the thyroid extract than any other treatment. On the other hand, where there has been enlargement of the gland itself, my best results have been from the use of the extract of suprarenal capsules; in my hands no other treatment has yielded such good results.

Dr. Wainwright: The doctor has read us a most excellent paper upon a subject which concerns alike the general practitioner, the ophthalmologist and the surgeon. Numbers of cases have been successfully experimented upon quite recently for removal of the gland, operations resulting in permanent cure in many cases. Now this is certainly a nervous disease—a disease of nervous origin. The cardinal symptoms characterizing this disease, tachycardia, tremor, exophthalmos, enlargement of the gland and the cachexia, would seem to prove its nervous origin, and I have yet to see an attack occurring in any but a neurotic subject. Yesterday I saw a case of this disease associated with chorea. Some time ago the patient became afflicted with chorea, and later on symptoms of exophthalmic goiter became manifest. From the association of the two diseases, and the manner of the development of the secondary affection, it would appear to be of nervous origin. The heart symptoms should be watched and guarded against; in these cases we have a decided hypertrophy of the heart. This is the only pathological condition in which we have a heart enlargement due to arterial obstruction, and this process of hypertrophy should be guarded against in every possible way. Where we have such a condition it is the duty of the physician to limit this hypertrophy, not only by materia medica but also by means of suggestive therapeutics. Any excitement or nervous strain invariably brings on aggravated symptoms and makes the patient worse; hence, absolute quiet should be insisted upon by the physician, thus modifying as far as possible the excessive heart action induced by nervous

excitement, which produces hypertrophy of the heart—the result of an increased amount of work thrust upon it.

Dr. Sexton: I have been much interested by the paper, and also by the discussions which have followed. I wish only to call attention to one feature of the subject, the association of neurasthenic cases. I think we are sometimes apt to "get the cart before the horse" in our interpretation of diagnostic points in the association of diseases. Referring to the case reported by Dr. Wainright, he speaks of the exophthalmic goiter having developed as a sequel to chorea. Why may not the chorea have been the result of the other underlying disease, which had been in a developmental stage in the system before the chorea appeared, but whose symptoms were perhaps masked by the more patent and easily recognized ones to chorea?

Dr. Morrison: I had a purpose in not giving treatment in the cases cited, because treatment in such cases is usually so unsatisfactory. It seems to me that the first duty of the physician is to get to the root of the business and find out what is the matter, if such a thing be possible, then treat the symptoms as they develop. I wish to call attention to the fact that the long train of nervous symptoms which usher in these cases is very similar to, and often identical with, those occurring in a great number of other diseases, and especially diseases of the pelvic organs. I think it is a subject worthy of more study and attention than it gets from the general practitioner. In regard to treatment, I have had cases in which the thyroid extract aggravated the symptoms and made the matter worse. I think I have no more to say, and thank you for the manner in which my paper was received.

A CORRECTION.

To the Editor of the Journal of The Kansas Medical Association.

DEAR SIR: In your June issue, under discussion of Dr. Johnson's paper, my remarks were erroneously reported. The criticism of Supreme Court attributed to me is a mistake. I said in substance that the Supreme Court had decided the law was constitutional—therefore if in the future its provisions were not enforced, we should not blame the law itself, but those whose duty it is to insist upon its enforcement. The language attributed to me is unjust to the able and distinguished members of the Supreme Court, and unfair toward your obedient servant.

H. O'DONNELL.

AN Irishman was being given an alcohol bath at the hospital and he remarked that this was the time he would like to be inside out.

Editorial.

WHO ATTEND MEDICAL SOCIETIES?

This question is easily answered. It's the busy, wide-awake men of the profession. Yet we often hear doctors say, "O, I am so busy I can't find time to go," and yet they overlook the fact that the busy doctor is the society man in every community. Reverse the order and you have it this way: The medical society man is the busy doctor. Why? Because he is abreast of the times, and when he goes away to attend the various medical societies to which he belongs his patrons know that it is for their good, and hence his practice is largely increased. The medical society is the place to go if yon wish to come in contact with the best and most advanced ideas in the profession. It is next to the post-graduate school in keeping polished and in accord with the very latest and best in the science of medicine. In another way it may be considered an outing, as you are away from the hum-drum of your every day work, which makes it restful and you go back to your practice refreshed mentally and physically.

So-CALLED health foods are multiplying at a rapid rate. One gentleman claims that he has invented one of the best. He was asked why he didn't put it on the market; he replied that all the good names were taken. Another gentleman met a friend on the street and noticed that he looked rather badly and inquired the cause. The answer came, "O, I suppose I have been eating too much health food." He no doubt told the truth.

DR. KOCH'S theory as to the non-transmission of bovine tuberculosis to human beings has received a hard blow by Dr. Garnault, a young French physician who was foolhardy enough to inoculate himself with matter taken from a tuberculous cow. In due course of time tuberculosis developed, and it is to be hoped that the young enthusiast may recover. Here is a chance for the anti-vivisectionists to register a kick.

MINISTERS and congressman have monopolized the testimonial business for patent medicines until recently when a flaming advertisement of a well known nostrum appeared in one of our daily papers with glowing testimonials from several prominent physicians of our sister city. Is the profession retrograding?

DR. SARA E. GREENFIELD, of Hiawatha, has received the appointment of bacteriologist to the state board of health. She will no doubt fill the position with credit to herself and the profession. By the way, the work of the bacteriologist is well suited to the woman physician, as it requires unlimited patience and perseverance and we usually find these qualities highly developed in the gentler sex.

DRUG addictions are alarmingly on the increase, and the more modern drug, cocaine, is having its share of victims. It is feared that physicians may be to blame in some cases at least. It should be used in eye, ear, nose or throat practice only as a local anesthetic, as it does not seem to have any curative properties. By doing this some of the danger of acquiring the habit would be avoided.

PALENTOLOGY in Kansas has received a setback. The skull found near Lansing, Kans., which scientists had declared was thirty-five thousand years old, has turned out to have been only thirty-one years in the bosom of old mother earth, so declares a Topeka attorney, who, it seems, proves his case.

THE State Board of Medical Examination and Registration will meet October 14th at the building of the College of Physicians and Surgeons, Kansas City, Kansas. Only ten minutes ride from the Union Depot. Take Grandview car.

WE very frequently hear physicians remark that a patient has no temperature, meaning, of course, no elevation of temperature. This mode of expression should be decried, as it is certainly wrong and there is no excuse for using it.

THE repair of heart wounds and blood vessels is being reported in many of the medical journals. Of course the subject is of great importance and our American surgeons will solve it, although it seems to be a hard nut to crack.

PARAFFIN injections are all the rage now if your nose happens to have a gully in it. We doubt whether it would be appreciable if you should be so unfortunate as to have a smear nose a la Kipling.

THE Mississippi Valley Medical Society will meet in Kansas City, Mo., October 15, 16, and 17. From the preliminary program sent out we can surely predict a very interesting meeting.

IT is reported that King Edward has entirely recovered and is in better health than ever. Wouldn't it be well to let the poor king have a rest and discuss something fresh?

DR. DOROTHY ALLEN, a young woman physician of Mankato, is running for coroner of Jewell county. Her opponent deserves the sympathy of the profession.

THE Kansas Medical College has become the medical department of Washburn College, Topeka.

Miscellaneous.

VARICOSE VEINS OF THE RIGHT UPPER EXTREMITY IN A CHILD.

Dr. Bertha E. Bush, in the *Woman's Medical Journal*, writes as follows:

This little girl is eight years of age and has had the present trouble all her life. Her parents are living and healthy, and her family history shows no similar case. One brother and one sister died of acute intestinal disease, each at the age of ten months, but were healthy at birth, and never exhibited any enlargement of the superficial veins.

The mother, since her first pregnancy, has had slight varices in the left popliteal space.

Present Condition.—The right upper extremity presents a general enlargement of the superficial veins along the anterior aspect of the thumb to the supra-sternal notch, with pouchy dilatations varying in size up to that of a small egg, on the thumb, in the palm, above the elbow and near the sterno-clavicular joint. The veins chiefly involved are the digital veins of the thumb, the veins of the palm of the hand, the radial and median in the forearm, the cephalic and basilic in the arm, and the superficial veins over the right external jugular as far as an inch and a half above the clavicle. During their course these vessels have a bluish color and an irregular, soft nodular feel, and the

position of their valves is not readily seen. At the larger dilatations the skin is thinned but there is no bruit or pulsation, except at the neck, where the mass is lifted by the carotid impulse beneath. The radial pulse is weaker on the right side than on the left. The greatest structural changes are observed in the right hand, which is wider and smaller than its mate and shows a large mass occupying the radial side of the palm, and extending between the metacarpals, to the dorsum of the hand. On the inner side the first joint of the thumb is covered by a soft mass almost continuous with that in the palm. The first three metacarpal bones are shorter, smaller and more widely separated than those of the left hand. There is no paralysis and the muscles, though relatively weaker, enable the child to eat, play, sew and write with the right hand.

These masses are mottled and purplish in color, and are not ordinarily tender, but become so when they are much enlarged, as is always the case after violent exercise or during fever.

A progressive increase in the size and number of the large dilitations has been noted since infancy; those above the elbow enlarging about four years ago, and those at the clavicle having appeared the most recently. Outside of the circulatory organs the examination is practically negative; the lungs, kidneys, spleen and digestive organs are normal. There are no enlarged superficial lymphatic glands—no evidences of inherited syphilis. The child is 46½ inches tall, weighs 44 pounds, and is of active, nervous temperament, but shows no nervous disease, general or local. The action of the heart is at all times somewhat irregular, but no endocardial murmurs have been noted.

IS MENTAL DIVERSION MENTAL REST?

Editorial Comment in American Medicine.

That physical rest may be obtained by bringing into play a different set of muscles from those previously in use is illustrated in the old story of the pugmill mule that was found to step off briskly in the afternoon if allowed to reverse the motion of the mill. The child who produces incipient giddiness by twisting up a swing, brings the unequal congestion of the centers of equilibrium to a balance by a rapid untwisting motion. Absolute rest of mind or body scarcely exists, relative rest or modification of the mode of activity gives a sensation of rest at any rate. After a long day of close visual application, when the hands press the tired eyes (although this particular mode of stimulating visual sensation may be harmful), how delightful to many

persons are the suggestive sensations of color—the kaleidoscopic effects that come and go with slight variations in pressure. The brain finds rest in an objectless play of color; so the tired mind seeks the rest from the stress of routine duties, not in the unconsciousness of sleep, but in the frolicsome vaudeville, or the perusal of light literature or the newspaper. Perhaps this explains to some extent the wonderful demand for books of fiction and magazines, as well as for the plotless stage performances so characteristic of these days of strenuous intellectual life.

SUGGESTIONS TO ANESTHETISTS.

Therapeutic Gazette.

Under this title De Tarnowsky advises as follows:

1. Always reassure the patient before beginning an operation.

2. Avoid or lessen the sense of suffocation by starting with a small amount of the anesthetic, holding the cone six inches from the patient's face, and decreasing the distance by gradual degrees.

3. Count out loud from one to a hundred, requesting the patient to repeat the numerals after you.

4. Push the anesthetic so soon as the higher centers show incoordination.

5. Always keep the lower jaw well forward, and only use the mouth-gag and tongue forceps when necessary.

6. During complete narcosis, watch (*a*) respiration, (*b*) pulse and facial artery, (*c*) pupils.

7. Consider (*a*) lateral rolling of eyeballs, (*b*) deep sighing respiration, (*c*) deglutition movements, (*d*) the hiccough which precedes the act of vomiting, as signals to push the anesthetic. The precursory hiccough is always a positive sign of returning reflexes; by immediately pouring an ounce of ether on the cone and precluding air, it is always possible to prevent actual vomiting.

A HARBINGER OF UNIFICATION.

New York Medical Journal.

Dr. De Lancey Rochester, of Buffalo, justly expresses in the June number of the *Buffalo Medical Journal*, gratification at the unanimous election to membership in the Erie County Medical Association of a physician who had been regarded before as a homeopathist. His election followed close upon his protest against the use of the words "homeopathic physicians" in a resolution presented before a general

meeting of the physicians of Buffalo. He is reported to have said that it was time to drop such qualifying adjectives, for sectarianism in medicine is really dead and it was wrong to keep up the semblance of it by the use of such misleading terms, and that, so far as he knew, no physician limited himself in his practice in such manner as the word homeopathy implied, and it was the manly and honest thing to come out openly and say so. It was Dr. F. Park Lewis who made this protest, and he was joined by Dr. A. T. Bull. We trust the day is not far off when their example will be widely followed by those whom the community looks upon as homeopathists.

STERILITY.

Therapeutic Gazette.

Martin, Levi and Carnett experimented upon dogs by cuttiug the vas and implanting the urethral end into the epididymis. The emissions from these dogs were swarming with living spermatozoa. It therefore seemed justifiable to perform an anastomosing operation upon man when a childless marriage was dependent upon azo-ospermia consequent upon a double obliterating epididymitis.

On December 24, under ether, the vas of the left side was freed at about the level of the top of the testis, and by means of a sharp-pointed pair of scissors, a slender bistoury, and a grooved director, such as are used by ophthalmologists, its lumen was opened by a longitudinal cut one-quarter of an inch long. The epididymis was then approached from the outer side, and its entire length was exposed. An incision into the tail failed to show the presence of a milky fluid, though cover-glass preparations subsequently examined held a few spermatozoa in the expressed fluid. A portion of the head was then picked up in toothed forceps and excised. A few minute, yellowish drops at once appeared on the resulting cut surface, made up in the main of spermatozoa, some of which, examined fifteen minutes later, were motile. Into this wound of the epididymis, the vas was implanted with four fine silver-wire sutures carried on small-face needles from the outer surface of the vas into its lumen, thence, from the cut surface of the opening made into the epididymis, through its fibrous tunic. A suture was placed at either end of the vas incision, and the latter was held open by the two other sutures, one to either side. The skin was closed by catgut.

Semen sent for examination nineteen days after operation, and twelve hours after emission, showed motile spermatozoa, apparently healthy, but corresponding, on microscopical study, to the type observed in the epididymis of the human testis removed after death and subjected to examination.

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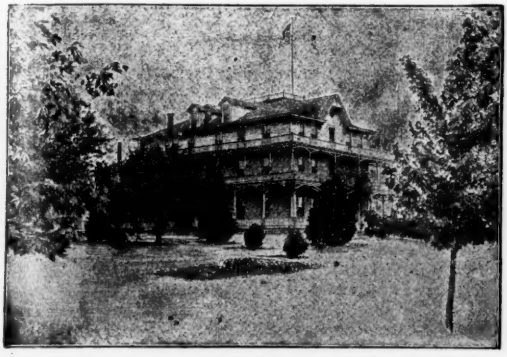

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